REMARKS

Rejections Under 35 USC §112, second paragraph

Claims 2, 7 and 14-20 have been rejected under 35 USC §112, second paragraph, as being indefinite. In response to these rejections, claims 2, 7 and 14 and 15 have been amended to recite --the formula-- rather than "a formula".

In addition, claims 1, 4, 7, 12, 21 and 42 have been amended to remove informalities, and to make the claims clearer.

Rejections Under 35 USC §103

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422).

Claims 1-20 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. in view of Mikuni et al. (US Patent No. 5,175,337) and further in view of either Nishino et al. (US Patent No. 5,739,205) or Litke (US Patent No. 4,533,422).

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Claims 21-42 and 40-44 have been rejected under 35 USC 103(a) as being unpatentable over DiLeo et al. (US Patent No. 4,209,358) in view of Burnett et al. (US Patent No. 2,628,178) and Gruber et al (US Patent No. 3,987,019).

The rejections under 35 USC §103(a) are traversed for the reasons to follow.

<u>Summary of the Invention</u>

The pending claims are directed to a "method for packaging a semiconductor die to form a semiconductor package". The method includes the step of "providing a leadframe configured for wire bonding to the die". The method also includes the step of "providing a cyanoacrylate adhesive material formulated to cure in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere". The adhesive material is initially applied to the die 10 (Figure 1A) or to the leadframe 14 (Figure 1A). For a leadframe 14 having a mounting paddle 12 (Figure 1B) the adhesive material can be applied to the mounting paddle 12. For a lead-on-chip leadframe 14A (Figure 5), the adhesive material can be applied to leadfingers 38 (Figure 5), that are configured to support the die 10A (Figure 5).

Following the adhesive "applying" step, a "placing" step is performed wherein the die is placed "on the leadframe with the adhesive material in contact with the die, and the leadframe to form an adhesive layer therebetween". The adhesive layer 20 (Figure 1B) is then subjected to a "curing" step "at the temperature and in the ambient atmosphere in less than 60 seconds to bond the die to the leadframe". Following the curing step, a "wire bonding" step and an "encapsulating" step are performed.

The method of the invention can also be performed with an "anaerobic acrylic adhesive" rather than a "cyanoacrylate adhesive" (page 9, lines 9-16 of the specification). Independent claims 21 and 42 define the method with an "anaerobic acrylic adhesive".

Argument

35 USC §103 Rejections over DiLeo et al. in view of either Nishino et al. or Litke

With respect to these 35 USC §103 rejections Applicants would argue that the cited combination of references does not teach or suggest all of the features of the presently claimed method and is non-enabling as to the presently claimed method. Applicants would further argue that there is no incentive in the references, or in the art, to combine the references in the manner of the Office Action.

DiLeo et al. was cited as teaching a method for fabricating a microelectronic device (LED-10) in which a semiconductor device (LED-10) is bonded to a lead frame 20 using an epoxy adhesive 31. However, DiLeo et al. does not teach the limitations of independent claims 1, 6, 12, and 15 of "a cyanoacrylate adhesive formulated to cure in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere". Further, DiLeo et al. does not teach the limitations of independent claims 21 and 42 of "an anaerobic acrylic formulated to cure in less than about 60 seconds at a temperature of about 20°C to 30°C and in an ambient atmosphere".

Rather DiLeo et al. teaches bonding of the microelectronic device (LED-10) using an unfilled epoxy cured at a temperature of 175°C to 185°C for a period of about 18 minutes (column 3, lines 49-50). DiLeo states at column 3, lines 34-36 that "epoxies that cure at room temperature" can also be employed. However, neither of the above claimed compounds (cyanoacrylate adhesive or anaerobic acrylic) is taught or enabled.

In addition, although room temperature curing is suggested by DiLeo et al. at column 3, lines 34-36, no further description or examples are given. Accordingly, DiLeo et al. is submitted to be non-enabling on a method of bonding a semiconductor device to a lead frame using a room

temperature curing process. In support of this argument, cases such as In re Wiggins, 488 F.2d 538, 179 USPQ 421 (CCPA 1973) have held that mere identification of a chemical compound does not constitute an enabling disclosure of the compound.

Further, DiLeo et al. is also non-enabling on the concept of bonding a semiconductor device to a lead frame using a compound which is formulated to cure in "less than about 60 seconds". Rather, DiLeo et al. teaches an 18 minute curing process (column 30, line 50), which is 18 times longer than the present method. DiLeo et al. thus does not teach another fundamental feature of the present method.

Nishino et al. and Litke et al. were cited as teaching that filled cyanoacrylate adhesive or anaerobic acrylic are used to bond electronic elements to various substrates. The Office Action states "that it would have been obvious to one of ordinary skill in this but to employ such filled adhesives in the bonding process of DiLeo et al. in place of the corresponding, analogous adhesive therein, mere substitution of one known room temperature curing adhesive for another involved".

However, a specific room temperature curing adhesive is not taught by DiLeo et al. In addition, a method for using such a room temperature adhesive to bond a semiconductor component to a lead frame is not enabled by DiLeo et al. Further, although Nishino et al. and Litke et al. suggest bonding of electronic elements to substrates, these references are non-enabling on a semiconductor packaging method. Accordingly, Applicants would argue that "mere substitution" of the adhesives taught by Nishino et al. and Litke et al. to the bonding process taught by DiLeo et al. would not achieve the presently claimed method.

35 USC §103 Rejections over DiLeo et al. in view of Mikuni et al. and further in view of either Nishino et al. or Litke

Mikuni et al. was cited as being similar to the teaching of Nishino et al. in that a cyanoacrylate adhesive is used in the "assembly of electronic parts" (column 1, line 30). However, the cited combination of references is still non-enabling on a method for bonding a semiconductor die to a lead frame using such a room-temperature, instant-curing adhesive.

Nishino et al. was additional cited as teaching the incorporation of a filler (silica) in a cyanoacrylate adhesive. However, Applicants would argue that there would be no incentive for one skilled in the art at the time of the present invention to use a filler in the DiLeo et al. process. In particular, DiLeo et al. specifically teaches an unfilled adhesive (column 2, lines 39-40) to overcome the problems associated with prior art adhesives "filled" with metallic particles (column 1, line 18). Although DiLeo et al. does not specifically teach away from the use of non-conductive fillers such as silica, it does teach away from the conductive fillers presently claimed (e.g., Ag, Ni, Fe).

In addition, although Nishino et al. teaches the use of silica, the purpose of the silica is to provide an adhesive composition having "high thixotropy, excellent compatibility, dispersibility, and storage stability with little separation phenomenon, and excellent adhesive strength" (column 2, lines 5-7). Applicant would thus argue that the prior art does not teach or enable a room-temperature, instant-curing adhesive composition having fillers which are selected to improve characteristics such as "thermal conductivity, mechanical strength, electrical conductivity, dielectric strength, moisture resistivity, or thermostability" of the adhesive composition in a semiconductor package.

35 USC §103 Rejections over DiLeo et al. in view of either Nishino et al. or Litke and O'Sullivan et al. and 35 USC §103 Rejections over DiLeo et al. in view of Mikuni et al. and further in view of either Nishino et al. or Litke and O'Sullivan et al.

O'Sullivan et al. was cited as teaching cyanoacrylate adhesive compositions formulated to cure in seconds. Admittedly this type of adhesive is known in the art. However, Applicants would again argue that the cited combination of references is non-enabling on the concept of bonding semiconductor dice to lead frames to make semiconductor packages using a room-temperature, instant-curing adhesive.

35 USC §103 Rejections over DiLeo et al. in view of Burnett et al. and Gruber et al.

With respect to this combination of references, Applicants would again argue that the cited combination of references is non-enabling on the concept of bonding semiconductor dice to lead frames to make semiconductor packages using a room-temperature, instant-curing adhesive. Further, Applicants would argue that although Gruber et al. teaches the use of silica fillers, there is no teaching of fillers which are selected to improve characteristics such as "thermal conductivity, mechanical strength, electrical conductivity, dielectric strength, moisture resistivity, or thermostability" of the adhesive composition in a semiconductor package.

Conclusion

In view of the amendments and arguments, favorable consideration and allowance of claims 1-22, and 40-44 is requested. Should any issues remain, the Examiner is asked to contact the undersigned by telephone.

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Respectfully submitted:

STEPHEN A. GRATTON
Registration No. 28,418
Attorney for Applicants

2764 S. Braun Way
Lakewood, CO 80228
Telephone: (303) 989-6353
FAX (303) 989-6538

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March 14, 2001
Date of Signature

Stephen A. Gratton
Attorney for Applicants